

## REMARKS

### *The Present Invention*

The present invention relates to a polybenzazole article that comprises a polybenzazole and a light-resisting agent.

### *The Pending Claims*

Claims 1-3 and 6 are currently pending. Reconsideration of the pending claims is respectfully requested.

### *Summary of the Office Action*

The Examiner rejects claims 1-3 and 6 under 35 U.S.C. § 103(a) as obvious in view of So et al. (U.S. Patent 5,552,221).

### *Discussion of the Obviousness Rejection*

According to the Examiner, So et al. discloses a polybenzazole article comprising polybenzazole and a naphthol dye. The Examiner agrees with Applicants that the naphthol dye disclosed by So et al. does not have the same structure as the light-resisting agents recited in the pending claims. However, the Examiner alleges that, since So et al. discloses the use of dyes that absorb light with a wavelength of 300-600 nm, the disclosed dyes inherently would be considered a light-resisting agent with the same functionality as the present invention.

The Examiner claims that since So et al. suggests using a dye that absorbs light with a wavelength of 300-600 nm, then any dye falling under this category must be suitable for use in the present invention. Moreover, the Examiner's contention is that not only would any dye that absorbs light in the range of 300-600 nm work, but one of ordinary skill in the art would be led to select the light-resisting agents recited in the pending claims, namely, aniline, *o*-phenylenediamine, *m*-phenylenediamine, *p*-phenylenediamine, *o*-aminophenol, *m*-aminophenol, *p*-aminophenol, 2-amino-4-nitrophenol, 2-aminophenol-4-sulfonamide, and 1,8-diaminonaphthalene. This simply is not the case.

The accompanying Declaration under 37 C.F.R. 1.132 illustrates that when used in combination with polybenzazole, the claimed light-resisting agents provided surprising and unexpected results. More specifically, polybenzazole articles that contained a dye recited in the pending claims (e.g., Samples 6-14 of Table 1 of the declaration) had a strength retention of 51-85%. A polybenzazole article that is *not* treated with a light-resisting agent (Sample 1) had a strength retention of only 35%. Therefore, the claimed polybenzazole article with a

light-resisting agent recited in the pending claims showed a marked improvement in strength retention compared to an untreated polybenzazole article (51-85% v. 35%).

In comparison, as demonstrated in the Rule 132 Declaration, not every dye that absorbs light with a wavelength of 300-600 nm is suitable for the present invention. For example, polybenzazole articles containing light-resisting agents disclosed by So et al., such as Rhodamine B, Acid Fuchin, sodium salt, Acid Black 48, and Acid Blue 40 (e.g., Samples 2-5 of Table 1 of the Rule 132 Declaration), had a strength retention of only 35-45%. Therefore, specific dyes disclosed by So et al. had little to no impact on improving the strength resistance of a polybenzazole article (35-45% v. 35% for an untreated article), *even though these dyes absorb light with a wavelength of 300-600 nm.*

Accordingly, the fact that a dye absorbs light with a wavelength of 300-600 nm does not mean that the dye inherently has the same functionality of the specific dyes recited in the pending claims. The addition of the light-resisting agents recited in the pending claims (i.e., aniline, *o*-phenylenediamine, *m*-phenylenediamine, *p*-phenylenediamine, *o*-aminophenol, *m*-aminophenol, *p*-aminophenol, 2-amino-4-nitrophenol, 2-aminophenol-4-sulfonamide, and 1,8-diaminonaphthalene) significantly improves the strength retention and light-resistance of polybenzazole articles compared to other conventional dyes that absorb light with a wavelength of 300-600 nm.

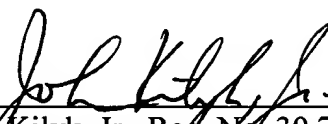
In other words, So et al. merely suggests using a dye that absorbs light with a wavelength of 300-600 nm; however, the specification of the instant patent application, as well as the Rule 132 Declaration submitted herewith, demonstrate that this teaching alone is not enough to inherently disclose or suggest the present invention. So et al. does not teach the specific light-resisting agents of the pending claims, nor does So et al. teach structural equivalents (as admitted by the Office). Thus, So et al. does not provide any teaching or suggestion that explicitly or implicitly would lead one of ordinary skill in the art to arrive at the present invention. In the absence of such a teaching or suggestion, it cannot be said that the present invention is obvious in view of So et al. Applicants respectfully request that the obviousness rejection be withdrawn.

### *Conclusion*

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

In re Appln. of Kodama et al.  
Application No. 09/502,834

Respectfully submitted,



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Date: March 24, 2003



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Tetsuo KODAMA et al.:

Serial No. 09/502,834:

Filed on February 11, 2000:

Group Art Unit: 1711

Examiner: Duc Truong

#15100  
3/28/03

For: POLYBENZAZOLE ARTICLE AND PRODUCTION METHOD THEREOF

DECLARATION UNDER 37 CFR 1.132

Honorable Commissioner of  
Patents and Trademarks,  
Washington, D.C. 20231

RECEIVED  
MAR 27 2003  
GROUP 1700

Sir:

I, Tetsuo KODAMA, whose full post office address is  
c/o Toyo Boseki Kabushiki Kaisha, Research Center, 1-1,  
Katata 2-chome, Ohtsu-shi, Shiga 520-0292 Japan, sincerely  
declare:

That my education and employment history is as follows:

That I was graduated from Department of Marine Science,  
Faculty of Marine Science and Technology, Tokai University  
in March 1981,

That I completed the master course study of  
Environmental Science at Hiroshima University, graduate  
school (Faculty of Integrated Arts and Science) in March  
1983,

In April 1983, I was employed by Toyo Boseki Kabushiki  
Kaisha, and I have been engaged in the research and  
development of base films of magnetic tapes, PPS, RO module,  
PBO and so on at Toyo Boseki Analytical Research Center;

That I am one of the inventors of the above-identified  
U.S. Patent Application No. 09/502,834 and familiar with the  
subject matter of this invention;

That I have reviewed the Office Action dated December  
23, 2002 issued in the above-identified application and  
have directly conducted the following experiments to show  
that the polybenzazole article of the present invention  
comprising a light-resisting agent defined in claim 1 is  
markedly superior in light resistance as compared to a  
polybenzazole article comprising, as a light-resisting  
agent, a dye described in So et al. (USP No. 5,552,221);

That the following Experiments demonstrate such fact,  
the results of which follow hereunder;

## Experiments

### (1) Object

To prepare the polybenzazole (PBO) article of the present invention comprising a light-resisting agent defined in claim 1 and a polybenzazole article comprising, as a light-resisting agent, a dye described in So et al. (USP No. 5,552,221) and evaluate the light resistance thereof.

### (2) Preparation method of samples for evaluation

#### (Preparation of PBO sample)

A spinning dope containing polyparaphenylene benzobisoxazole (14.0% by weight) obtained by the method described in USP 4,533,693 and having an intrinsic viscosity as measured with a methanesulfonic acid solution at 30°C, of 24.4 dL/g, and polyphosphoric acid containing phosphorus pentaoxide in 83.17% by weight was spun. The dope was passed through a metal net filter, and kneaded and defoamed in a twin screw kneader. The pressure was elevated, the dope temperature was maintained at 170°C, and the dope was spun at 170°C from a spinneret. The delivered yarns were cooled with cooling air at 60°C and wound around a godet roller to afford a spinning speed. The yarns were led into an extraction (coagulation) bath of a 20% by weight aqueous phosphoric acid solution maintained at a temperature of 20±2°C. The yarns were successively washed with ion exchange water in a second extraction bath, and immersed in a 0.1 mol/L sodium hydroxide solution for neutralization. The resulting undried PBO yarns were preserved in water and used as a sample.

#### (Preparation of treating solution for light-resisting agent)

Each light-resisting agent shown in the following Table 1 was dissolved in water such that the concentration was 1 g/100 ml and the liquid temperature was about 40°C to give a treating solution. However, since 1,8-diaminonaphthalene has low solubility, the concentration was less than 1 g/100 ml.

#### (Treatment with light-resisting agent)

The undried PBO yarn (103.4d, 66f) obtained above was

placed in each treating solution while preventing entanglement, and stood at about 40°C for 4 hr. Redundant treating solution was removed by pressing waste (JK wiper paper) and the yarn was dried to give a sample for evaluation.

### (3) Evaluation of light resistance

The samples for evaluation (PBO fiber) obtained above were folded three times (for forming a kink band and accelerating the light resistance evaluation) and subjected to xenon light exposure at 83°C for 24 hr. The tensile strength of mainly the part folded 3 times was measured and strength retention was calculated with the tensile strength (DT 31.2 (g/d)) of dry PBO yarn samples free of treatment with a light-resisting agent as 100%.

### (4) Evaluation results

The obtained strength retention is shown in the following Table 1.

Table 1

Sample	light-resisting agent	strength retention (%) after xenon light exposure for 24 hr
1	Blank (untreated)	35
2	Rhodamine B	35
3	Acid Fuchin, sodium salt	43
4	Acid Black 48	45
5	Acid Blue 40	40
6	o-Aminophenol	54
7	2-Amino-4-nitrophenol	52
8	2-Aminophenol-4-sulfonamide	55
9	1,8-Diaminonaphthalene	51
10	m-Phenylenediamine (m-PDA)	57
11	p-Phenylenediamine (p-PDA)	67
12	m-PDA/p-PDA=1/1	85
13	o-Aminophenol/p-PDA=1/1	76
14	2-Amino-4-nitrophenol/p-PDA=1/1	70

The light-resisting agent (Samples 6 - 14) of the present invention is oxidized in an aqueous solution to form a condensate (colors the aqueous solution black), reacts with or adsorbs to PBO yarn to dye the PBO yarn. By mixing two kinds of light-resisting agents, the oxidation/condensation proceeds further to afford a striking light resistance effect (higher strength retention (%)) (Samples 12 - 14).

(5) Conclusion

The polybenzazole articles (Samples 6 - 14) of the present invention comprising a light-resisting agent defined in claim 1 showed significantly higher strength retention (%) (dramatically superior in light resistance) after xenon light exposure for 24 hr, as compared to polybenzazole articles (Samples 1 - 5) comprising, as a light-resisting agent, a dye described in So et al. (USP No. 5,552,221).

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed at Shiga, Japan on this            day of March, 2003

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Tetsuo KODAMA